homes, where they sickened. The incidence of the epidemic was on those fraternities only who had included raw oysters in their *menu*; and even amongst these some marked escapes were in persons who, for one and another reason, had not consumed oysters. The suspected oysters came from Long Island Sound, where they had been put to "fatten" in a fresh-water estuary within 400 feet of a sewer known to have been receiving typhoid material. The last piece of evidence bearing upon this subject comes from an official source. It is announced that, on the strength of a report by the Medical Officer of the Local Government Board, as to the diffusion of cholera in England during 1893, which report is now passing through the press, an inquiry has been commenced into the circumstances under which oysters are cultivated and stored round our coasts. The reference is clearly to the serious outbreak of cholera at Grimsby and Cleethorpes, and to the diffusion of the epidemic from those places, whence a large distribution of oysters and other shellfish is constantly in progress.

Whatever be the outcome of the inquiry which has been instituted, it is certain that two questions will come to the fore: (1) the need for control over our oyster-beds, and (2) the desirability or not of allowing crude sewage to be discharged direct into the sea, or into tidal estuaries.

NOTES.

SIR HENRY ROSCOE has been made Chairman of the Select Committee of the House of Commons appointed to enquire whether any, and what, changes in the present system of weights and measures should be adopted.

WE regret to announce that Mr. John Whitaker Hulke, F.R.S., president of the Royal College of Surgeons of England, died on Tuesday, from broncho-pneumonia. An obituary notice in the *Times* furnishes us with the following particulars with regard to his career. Mr. Hulke was born in 1830, and was the elder son of a well-known and highly-esteemed surgeon at Deal, where his family had been settled for several generations. He was educated at King's College School, and subsequently spent two years in Germany, where he thoroughly acquired the language. After a varied experience as surgeon to the hospital at Smyrna, during the Crimean War, and in King's College Hospital, he migrated to Middlesex Hospital. In 1859 he received the Jacksonian prize of the Royal College of Surgeons for his Essay on Diseases of the Retina, and soon afterwards he brought out a treatise on the ophthalmoscope, then a novelty in eye-practice. This led to his being regarded mainly as an ophthalmic surgeon; but he contributed to general surgery in the Medico-Chirurgical *Transactions*, and joined Mr. Holmes in editing the third edition of his "System of Surgery." He was elected a fellow of the Royal Society in 1867. In 1876 he was appointed an examiner in anatomy and physiology at the College of Surgeons; and in 1880 became a member of the Court of Examiners, an office which he held for ten years. In 1881 he was elected a member of the Council; and, after twice serving the office of vice-president, he became president in 1893, and has died in office. He had been president of the Pathological and Ophthalmological Societies, and at the time of his death was president of the Clinical Society and librarian of the Royal Medical and Chirurgical Society. Mr. Hulke was, however, much more than an accomplished surgeon. He was a good comparative anatomist, botanist, and geologist; and was at one time president of the Geological Society of which he was elected the Treasurer on February 15. He was an artist in water colour, and was able both to model in clay and to carve in marble. His loss is a real one to the medical profession, in which he was esteemed as a man of the highest probity and sagacity.

WE notice the death, at the age of eighty-eight, of a gifted mathematician, the Rev. T. P. Kirkman. He was elected a Fellow of the Royal Society in 1857.

THE following deaths have occurred among scientific men abroad:—Dr. Gerhard Krüss, Extraordinary Professor of Chemistry in the University of Munich. M. Jules Regnauld, Professor of the Paris Faculty of Medicine, at the advanced age of ninety. The Rev. J. Owen Dorsey, a well-known ethnologist, at Washington, February 5. Prof. Dorsey had been connected with the Bureau of Ethnology, since 1877. He was the president of the Anthropological Section of the American Association for the Advancement of Science in 1893. We also have to record the death, at the early age of forty-five, on January 28, of Dr. F. Schmitz, Professor of Botany at Greifswald. For many years past, Dr. Schmitz had turned his attention chiefly to the study of the Algæ, and especially of the red sea-weeds or Florideæ, to our knowledge of the life-history of which he had made substantial additions. He published, in the year 1877, an account of the formation of auxospores in the diatoms, and, in 1879, a description of the green Algæ of the Gulf of Athens.

PROF. L. GUIGNARD, President of the Botanical Society of France, has been elected to succeed the late Prof. Duchartre in the Section de Botanique of the Paris Academy of Sciences.

LORD RAYLEIGH will deliver a course of six experimental lectures on "Waves and Vibrations," at the Royal Institution, on Saturdays, March 2, 9, 16, 23, 30, and April 6. He will also deliver the Friday evening discourse on April 5, when his subject will be "Argon, the New Constituent of the Atmosphere."

A NEW thallium mineral has just been described, under the name of Lorandite, by Prof. Krenner, of Buda-Pesth. The new mineral occurs sparingly, in association with realgar, at Allchar in Macedonia. It is found as transparent crystals belonging to the Monosymmetric system, and having the form of plates or short prisms; its colour varies from cochineal-red to kermesite-red. The mineral proves on analysis to correspond to the formula $TlAsS_2$, and contains 59·5 per cent. of thallium.

WE have received from the Russian Chemical Society a pamphlet devoted to the description of the new chemical laboratory which has been erected at the St. Petersburg University. The laboratory has been built in accordance with the requirements of modern scientific investigation, and has cost £32,720. All branches of research have separate large halls, special rooms being allotted to physical chemistry and accurate physical measurements. Although the laboratory is behind many of the largest laboratories of West Europe, it has the advantages of perfect arrangements for each separate worker, and it decidedly has no rivals for the perfection of ventilation. The total amount of warm air supplied to all the halls of the building attains 823,000 cubic feet per hour, so that the air will be totally changed from one to five times per hour in each separate hall.

THE Russian Geographical Society awarded, at its meeting of January 30, the Constantine medal to S. N. Nikitin for his numerous works on the geology of Russia; the Count Lütke medal to P. K. Zalesskiy for geodetical work in Turkestan; the great gold medal, to N. A. Karysheff for his work, "The Land rented by the Peasants"; and the Prjevalsky premium, of £60, to V. A. Obrucheff for his last journey in Turkestan and Central Asia. Small gold medals were awarded to the French geodesist, M. Defforges, and the Austrian geodesist, Baron Sterneck, for their pendulum observations in Russia, and to M. Sieroszewski for his MS. on the Yakutes; and the great silver medal of Prjevalsky's name to Baron Toll and Lieutenant Shileiko, for their last journey to Arctic Siberia. Eleven silver medals were also awarded for minor works.

Severe frost has continued in nearly all parts of the British Islands, but in England and Ireland the cold was rather less intense last week. The frost has now continued for over four weeks, and although the period is shorter than in some other frosts during the present century, the intense cold experienced has been seldom equalled. There were no instances of temperatures below the zero, as in the preceding week, but readings of 20°, and even 30°, below the freezing point have been recorded. At Greenwich the mean temperature since the commencement of the frost is 28°, and the mean of the night readings is only 22°. Very little snow has fallen in any part of the British Islands, but the ground is still covered with snow from the fall during the earlier part of the frost. The type of weather has undergone a very considerable change, and the last few days have been much less cold, although frost occurs each night. The European anticyclone appears to have thoroughly given way, and in the course of two or three days the barometer has fallen to the extent of nearly an inch over Scandinavia. An anticyclone is, however, situated over the British Islands, and while this continues frost is still likely to be experienced.

At the meeting of the Anthropological Institute on February 12, Mr. Brabrook drew attention to the work of the Ethnographic Survey Committee of the British Association, on which the Institute was represented by Mr. Francis Galton, Dr. Garson, and himself. He said the committee had been successful in obtaining a long list of places suitable for survey, and had prepared an octavo pamphlet, of twelve pages only, which gave comprehensive instructions to those who were willing to engage in it. What the committee now desired was to increase the number of observers, and he appealed to the members of the Institute for assistance in this respect. The committee were especially anxious to induce medical men to interest themselves in obtaining the necessary physical measurements in suitable places. For this purpose, they would be glad to furnish instruments, and render any other assistance that might be necessary and practicable. All their experience had shown them how valuable the results of their work would be likely to be, and how desirable it was that it should be proceeded with without delay.

The magnanimous spirit which the Academy of Natural Sciences of Philadelphia has shown towards the circular sent out by the Royal Society, asking for co-operation and suggestions in making a subject-catalogue of scientific papers, is an indication of the unity of the interests of scientific societies. A report has been adopted by the Academy to the following effect :—(1) That a catalogue of scientific papers as proposed by the Royal Society is desirable, and that international co-operation should be engaged in its preparation. (2) That in order to secure uniformity in all parts of such a catalogue, a central bureau, as suggested by the Committee of the Royal Society, appears to be necessary, rather than that separate portions of the catalogue should be prepared by various institutions, such central bureau to be under the direction of the Royal Society, from which the proposition emanates; all publications of societies and monographs to be sent to such central bureau; the expenses to be met by returns from the sale of copies of the catalogue. (3) That such a catalogue should be classified, and should be issued at least once a year, each volume to be provided with an alphabetical index. (4) That the scope of such a classified catalogue should embrace the various yearly bibliographies of special sciences now issued. (5) That whenever translations or summaries are believed to be desirable, English should be made the basis of the catalogue.

The fragility of human promises is proverbial. The following dialogue, which took place in the House of Commons on Monday, furnishes another illustration of this quality :—Mr. Bartley asked the Chancellor of the Exchequer whether work was resumed last autumn at South Kensington Museum, as promised by him, so as to leave everything ready for the commencement of those buildings as soon as the money was voted by the House of Commons; and what sum was to be taken in the coming year's Estimates for the completion of those buildings in accordance with the pledge of the present President of the Local Government Board in March, 1894, on behalf of the Government. The Chancellor of the Exchequer said the demands upon the Estimates under other heads had proved so heavy that it had been found necessary to restrict the expenditure on bricks and mortar to the lowest possible point, and he feared that it would not be possible to undertake any large expenditure in connection with South Kensington Museum at present. Mr. Bartley: May I ask the right hon. gentleman whether it is not the fact that last year a certain estimate was allowed to pass on the distinct pledge from the Government that this year there would be a vote for this building? The Chancellor of the Exchequer: It was intended to do so, but, as we were reminded the other night, we ought to cut our coat according to our cloth, and the hon. member must allow me to know what our cloth is.

The anniversary meeting of the Geological Society was held at Burlington House, on Friday, February 15, when the medals and funds were awarded as follows :—The Wollaston Medal, to Sir Archibald Geikie, F.R.S.; the Murchison Medal, to Prof. G. Lindström, ; the Lyell Medal, to Prof. J. F. Blake; the Bigsby Medal, to Mr. C. D. Walcott; the balance of the proceeds of the Wollaston Fund, to Mr. W. W. Watts; that of the Murchison Fund, to Mr. A. C. Seward; a moiety of the balance of the proceeds of the Lyell Fund, to Mr. P. F. Kendall; and the remaining moiety to Mr. B. Harrison. The President delivered his annual address, the subject bearing on the Palæozoic Crustacea. The following is a list of the officers and Council elected at the meeting for the ensuing year. (The names in italics represent new officers and members of Council.) President: Dr. H. Woodward, F.R.S. Vice-Presidents: Prof. A. H. Green, F.R.S., *W. H. Hudleston*, F.R.S., R. Lydekker, F.R.S., *Lieut-General C. A. McMahon.* Secretaries: J. E. Marr, F.R.S., J. J. H. Teall, F.R.S. Foreign Secretary: J. W. Hulke, F.R.S. Treasurer: *Dr. W. T. Blanford*, F.R.S. Members of Council: H. Bauerman, Dr. W. T. Blanford, F.R.S., *Prof. W. Boyd Dawkins*, F.R.S., Sir John Evans, K.C.B., F.R.S., Prof. A. H. Green, F.R.S., Dr. J. W. Gregory, *R. S. Herries*, Dr. G. J. Hinde, T. V. Holmes, W. H. Hudleston, F.R.S., J. W. Hulke, F.R.S., Prof. J. W. Judd, F.R.S., R. Lydekker, F.R.S., Lieut.-General C. A. McMahon, J. E. Marr, F.R.S., *H. A. Miers, E. T. Newton*, F.R.S., F. Rutley, J. J. H. Teall, F.R.S., *W. Whitaker*, F.R.S., Rev. H. H. Winwood, Dr. H. Woodward, F.R.S., H. B. Woodward.

The first scientific account of the Chilo-Argentine earthquake, which has reached Europe, is probably that written by M. A. F. Nogués (*Comptes rendus*, vol. cxx. 1895, pp. 167–170). The earthquake was remarkable for its intensity and long duration, the amplitude of the oscillations, and the absence of subterranean sounds. The epicentral zone is elliptical in form, its longer axis being directed nearly north and south, and passing by Rioja, San Juan, and Mendoza. The first two of these towns were severely damaged, and a large number of persons in them were killed and wounded. The boundary of the disturbed area is as yet undetermined, but it must have included a great part of the Argentine Republic and of the north of Chili. Within the epicentral area, the duration of the shock was fifty-five seconds; at Santiago Observatory, where it was registered by a seismograph, the duration was 1m. 40s., and the amplitude of the oscillations 2·5 c.m.

THE *Revue Scientifique* contains a full discussion of the causes of mountain sickness, by M. H. Kronecker, who was sent to investigate the conditions under which the proposed railway to the top of the Jungfrau could be worked without endangering human life. M. Kronecker and six other persons from Berne were carried from Zermatt to a point near the summit of the Breithorn, 3750 m. above sea-level. It was proposed to reach the summit itself, but it was impossible to proceed without additional carriers, the work being much more laborious at high altitudes. But at the altitude reached, all the symptoms of mountain sickness had shown themselves—acceleration of the pulse and of respiration, desire for rest, even after a very slight effort, and headache. M. Kronecker arrived at some interesting conclusions regarding mountain sickness. It sets in at altitudes varying with different persons. Beyond 3000 metres it attacks all persons as soon as they indulge in the least muscular effort, but children and very old people are much less subject to it than others. It also varies with the character of the mountains, being usually less serious on isolated peaks. Persons in good health can stand passive transport to about 4000 m. without inconvenience, but they should not remain more than two or three hours at the top. A prolonged sojourn may be disastrous in its effects upon health, as it proved to be in the case of Dr. Jacottet. For the purposes of the railway, M. Kronecker recommends that all guards and other officials should be carefully selected and, if possible, acclimatised or frequently changed between the stations. Finally, the summit station should be arranged so that no further ascent whatever is necessary to get the full benefit of the view.

AT a recent meeting of the Société Française de Physique, M. de Kowalski read a paper on the conditions necessary for the production of kathode rays. Starting from an experiment due to Goldstein, in which in a vacuum tube having a constriction at its middle, it is found that the kathode rays are formed not only at the negative electrode, but also at the constriction, the author has made several experiments, using tubes of different shapes. He finds that wherever the electric discharge is sufficiently dense, as near the electrodes or in a capillary tube joining the two parts of a vacuum tube, kathode rays are produced. These rays are propagated in straight lines, are deviated by a magnet, and produce a bright patch where they strike the glass. The author has also succeeded in obtaining kathode rays in a tube without electrodes. This tube had somewhat the shape of an elongated hour glass, and was placed alongside a discharger, through which "Tesla currents" were passed. Under these circumstances kathode rays are produced at either end of the capillary tube forming the central part of the vacuum tube. M. de Kowalski concludes from his experiments (1): that the production of kathode rays is not connected with the disintegration of metallic electrodes in a rarefied gas; (2) that these rays are produced wherever the density of the discharge is sufficiently great; (3) that the direction of the rays is the same as that of the lines of flow of the current at the point where they are produced, and that they are propagated in the opposite direction to that in which positive electricity is supposed to flow.

AT the same meeting at which the above paper was read, M. Curie described some experiments he had made to see whether light rays were deviated by a magnetic field in the same manner as kathode rays. He has obtained no deviation, although his apparatus permitted him to pass the light rays for a distance of 20 cm. in a field having an intensity of 14″000 units, the direction of propagation of the light being perpendicular to the lines of force of the magnetic field. The experiment was made in air, as well as in carbon bisulphide in which sulphur had been dissolved. The author, although he does not think the above experiments are conclusive proof that kathode rays are radiation of a different nature from that which constitutes light, yet thinks they tend to show that there is some difference. Furthermore, if the kathode rays are analogous to light rays, it is difficult to explain the absence of double refraction when a magnetic field acts on the kathode rays.

THE triple number, pp. 10-12, of the *Bulletin* of the Botanical Department, Jamaica, is entirely occupied by a list of the more interesting trees and shrubs, 109 in number, grown in the Botanic Garden at Castleton, near Kingston.

IN the most recent part of the *Records of the Botanical Survey of India*, the Indian Government publishes a report of a Botanical tour in Kashmir, by Mr. J. F. Duthie, director of the Botanical Department of Northern India, accompanied by a map.

THE *Bulletin* of the Royal Gardens, Kew, No. 96, for December, 1894, contains an interesting article on "Cultural Industries in Dominica," an island which, since the abandonment of the coffee plantations, which were at one time its staple industry, is very far from yielding the economical products which might be expected from its climate and the fertility of its soil. A brief account is given of the four Botanic Stations in the Leeward Islands, those of Antigua, St. Kitts, Dominica, and Montserrat.

THE 1895 *Annuaire* of the Royal Observatory at Brussels, edited by M. F. Folie, has been received. The *Annuaire* is is second only to that published by the French Bureau des Longitudes. It comprises ephemerides containing the principal astronomical data for the current year; geographical, meteorological, and other statistics; physical constants; and several articles, among them being three by M. Folie, on diurnal and annual aberration.

THE Smithsonian Report for 1893 has recently been issued. The report comprises a selection of miscellaneous memoirs embracing a considerable range of scientific investigation and discussion. This collection of reprints and translations, running into very nearly seven hundred pages, contains articles of interest to workers in all branches of science. Among the contributions to the Report is a monograph on "North American Bows, Arrows, and Quivers," by Dr. O. T. Mason. The paper, which is illustrated by fifty-seven plates, deals with the types of bows, arrows, and quivers of the North American aborigines, with incidental references to similar forms found elsewhere.

MESSRS. J. AND A. CHURCHILL have nearly ready the second volume of "Chemical Technology," edited by Mr. C. E. Groves, F.R.S., and Mr. William Thorp. This volume is devoted to lighting by candles and oils, and is illustrated by about 350 figures; the section on fats and oils being written by Mr. William Y. Dent; stearine, by Mr. John McArthur; candle manufacture, by Messrs. L. Field and M. A. Field; the petroleum industry, by Mr. Boverton Redwood; lamps, by Mr. Boverton Redwood; and miners' safety lamps, by Messrs. Boverton Redwood and D. A. Louis. The third volume of the same work, containing gas lighting, by Mr. Charles Hunt, of Birmingham, and electric lighting, by Prof. Garnett, of the Technical Board of the London County Council, is in a very forward state.

MESSRS. MACMILLAN AND CO. will publish early in March the treatise on "Bessel Functions and their Applications to Physics," by Profs. Gray and Mathews, which has already been announced. The work, after an introductory chapter on the problems which gave rise to the functions, deals with their properties, expansions involving them, semi-convergent expansions, Fourier-Bessel expansions, complex theory, definite integrals, and the relation of the functions to spherical harmonics. The physical applications embrace flow of heat and electricity, vibrations of membranes, hydrodynamics, electrical waves along wires, diffraction, and a number of miscellaneous problems. Numerical tables are appended, and also the Tables of Functions with imaginary argument, which have been prepared by Prof. A. Lodge for the British Association. A note containing useful formulæ for the calculation of the roots of Bessel Functions and others related to them, has been added from a manuscript placed at the disposal of the authors by Prof. J. McMahon.

WE have received Parts iv. and v. of *Indian Meteorological Memoirs* (vol. v.), containing the discussion of hourly observations made at Allahabad and Lucknow, forming a portion of the harmonic analysis of the observations recorded at twenty-five observatories in India, since the year 1873. The investigation is carried out in a most thorough manner, and there can be no doubt that when the work is complete, and the results correlated, much light will be thrown upon the laws which regulate atmospheric movements in those parts. In any case, the discussion will take rank amongst the most important of the kind hitherto undertaken by any country.

A COMPOUND of grape sugar with one of the acid radicle derivatives of hydrazine recently prepared by Herr Struve, a pupil of Prof. Curtius, is described by Dr. Wolff, of Berlin, in the current *Berichte* of the German Chemical Society, and, on account of its properties and mode of formation, appears likely to be of considerable service in the commercial extraction of pure dextrose from syrupy mixtures. It is first shown that the sugars of the aldose type react with the acidylhydrazides to produce an aldose-acidylhydrazide by direct addition with elimination of a molecule of water. Thus, in the case of dextrose and benzhydrazide the following equation represents the change :

$$C_6H_5.C : O.NH.NH_2 + O : C_6H_{12}O_5 = C_6H_5.C.O.NH.N.C_6H_{12}O_5 + H_2O.$$

When dextrose and benzhydrazide are digested with 96 per cent. alcohol for five or six hours in a flask provided with an upright condenser, the new compound is produced in solution in the alcohol, and upon subsequent evaporation it separates in the form of acicular crystals, which can readily be purified by recrystallisation from alcohol. The crystals melt at 171–172° with partial decomposition. As lævulose does not react with benzhydrazide, pure dextrose can readily be isolated from the mixture of lævulose and dextrose in ordinary invert sugar by utilising the above reaction. The invert sugar is evaporated to a thick syrup, and the latter digested with alcohol and benzhydrazide for about six hours in a reflux still. The alcoholic solution is then evaporated over a steam-bath almost to dryness, the lævulose is extracted by washing with a minimum of alcohol, and excess of benzhydrazide removed by means of ether. Pure dextrose-benzhydrazide is then obtained in good crystals by two recrystallisations from alcohol. The recovery of dextrose from this compound with benzhydrazide is a very simple matter, for the compound is immediately broken up by boiling water into dextrose and benzhydrazide. It is found convenient in practice, however, to remove one of the products of the dissociation, the benzhydrazide, by precipitation as the insoluble benzal-benzhydrazide by means of benzaldehyde, which is found to be a most valuable reagent for the purpose. After filtration the liquid is evaporated to dryness, dissolved in cold water, whereby any traces of unprecipitated benzal-benzhydrazide are left behind, and again evaporated to dryness. The last traces of impurities, chiefly benzaldehyde and benzoic acid, are finally removed by dissolving the dextrose in alcohol and precipitating with ether. The dextrose eventually obtained by evaporation of the clear solution is quite pure. Dr. Wolff lastly states that the above is a general process for separating aldoses from mixtures of sugars, and he is experimenting with a view to its adoption on the large scale.

THE additions to the Zoological Society's Gardens during the past week include a Snowy Owl (*Nyctea scandiaca*) from Norway, presented by Miss Wright ; a Dunlin (*Tringa alpina*), British, purchased.

OUR ASTRONOMICAL COLUMN.

MARS IN 1894.—Signor G. Schiaparelli remarks, in No. 3271 of the *Astronomische Nachrichten*, that the unfavourable state of the atmosphere during the opposition of Mars last year rendered magnifications beyond 200 impossible except in rare instances. Speaking generally, he says that the "seas" were less pronounced than in 1877, and the "canals" were better visible in 1894. and seen in greater numbers. Some of the largest ones showed faint traces of doubling, but, with the magnifying powers used, nothing could be made out with certainty on this point. The southern pole cap became invisible in the 18-inch Milan refractor at the end of October. On October 8 it had already become very faint. The total disappearance cannot have been later than October 29, *i.e.* on the 59th day after the southern solstice of the planet. This is unusually early. In 1877–78 it was well seen as late as 98 days after the solstice. In the present case it is pretty certain that the whole of the southern pole cap was melted. A great change was also observed in the isthmus or peninsula of Hesperia, which separates the Mare Tyrrhenum from the Mare Cimmerium. It was apparently separated into two unequal portions by a newly formed-channel. The Mare Sirenum, which in October, 1892, had been separated into two parts, was in October, 1894, seen to have resumed its ordinary aspect. But on November 21 the separation had reappeared. "This fact," says Schiaparelli, "and other analogous ones which I have observed in previous oppositions, lead to the conclusion that the abnormal changes in the markings of Mars do not take place by chance and without regularity, but that the same variation may reappear, with the same aspect, even after a long interval of time. The form and extent of such changes is determined by some element which is stable, or at least periodic."

NOVEL METHODS IN PHOTOMETRY.—The determination of the times of exposure of a photographic plate which are required to produce the same density of film when exposed to different light sources, forms the basis of the methods recently adopted by Dr. Janssen for investigating the brightnesses of the heavenly bodies (*Bull. Mens. Soc. Ast. de France*, February). In the case of stars, the plate is placed a little within the principal focus of a telescope, so that a disc, or "stellar circle," replaces the almost point-like image ordinarily obtained ; a series of exposures is made on one star, and another series on the star to be compared with it ; the two images of the same density are thus identified, and the photographic brightnesses of the two stars are inversely as the durations of the corresponding exposures. To compare the light of a star with the sun, an opaque screen, pierced with holes of the same size as the stellar circles, is placed in front of the photographic plate, and these holes admit sunlight to the plate at the moment a triangular aperture in another metal plate is passed over them on releasing a spring ; in this way a series of circles of increasing intensity is impressed on the plate, and can be compared directly with the stellar circles.

In its application to nebulæ, Dr. Janssen's method promises to be of great value. On the same plate which has been exposed to a nebula, a series of "stellar circles" is formed by directing the instrument to a star in the neighbourhood which shows no signs of variability. In the future, when one wishes to obtain a photograph of the nebula which will be strictly comparable to one taken previously, it will only be necessary by means of stellar circles to determine the exact exposure which should be given.

From an inquiry into the photographic luminosity of the tail